ELECTRODIAGNOSTIC ANALYSIS OF COMMON PATHOLOGICAL CONDITIONS

1. Disorders of Peripheral Nerves

Electrodiagnostic techniques play important role in diagnosis of peripheral nerves disorders. The Seddon classification of nerve injuries divided peripheral nerve disorder into three categories- Neuropraxia Axonotmesis and Neurotmesis.

a. Neuropraxia:

When there is distraction injury or blockage in the myelin sheath, conduction above and below the blockage is usually normal. In Neuropraxia lesions, the compression disorder are most common e.g. bell's palsy (facial nerve), Saturday night palsy (radial nerve), compression in spiral groove,pressure over the peroneal nerve at the fibular head, carpal tunnel syndrome (median nerve entrapment), tarsal tunnel syndrome (tibial nerve entrapment).

Electrodiagnostic findings:

- EMG:

In acute condition when there is no denervation the EMG will be normal at rest. Recruitment is normal accept in conduction block, where it is decreased.

- NCS:

In this lesion, the nerve conduction test is more useful to detect the demyelination in comparison to axonal degeneration. In demyalination, both sensory and motor nerve conduction velocities will be decreased.MUAP amplitude will be reduced due to temporal dispersion and not because of axonal damage.

b. Axonotmesis:

Axonotmesis occurs when the nuclei or cell of the axon is destructed or due to long – standing neuropraxia or from a traumatic lesion.

Electrodiagnostic findings:

- EMG:

In spontaneous activity, fibrillation potentials and positive sharp waves are present. Motor unit recruitment is decreased.

- NCS:

Both motor and sensory conduction velocities will be decreased. Distal latencies will be increased.

c. Neurotmesis:

This occurs when the nerve fiber is completely cut. There is total loss of axonal function with disruption of neural tube. Conduction ceases below the level of lesion.

Electrodiagnostic findings:

- EMG:

In spontaneous activity, fibrillation potentials and positive sharp waves will be seen with the muscle at rest. Activity will be produced with the attempted voluntary contraction. Motor unit recruitment is decreased.

- NSC:

Here nerve conduction studies

cannot be performed.

2. Poly Neuropathy:

In poly neuropathy, there is sensory change, distal weakness and hyporeflexia. There occurs demyelination and damage of the axons. The NCSs and EMG studies have an important role in evaluation of these diseases.

Electrodiagnostic findings:

➢ EMG:

The MUAP duration and amplitude may be reduced. If there is axonal damage, then fibrillation, positive sharp waves and fasciculations are present. The motor unit recruitment is decreased.

➢ NCSs:

In demyelination, the NCSs provide useful information. Sensory nerve conduction velocity may be decreased. The evoked potential will be typically reduced in amplitude.

3. Myopathy:

It is a disorder of muscles, which is of the following types: congenital, inflammatory, metabolic and muscular dystrophies. There occurs primarily the weakness of the muscles.

Electrodiagnostic findings:

➢ EMG:

In early stages, slow and prolonged insertional activity is seen. Spontaneous activity can be frequently noted here. In common myopathies, positive sharp waves and fibrillation potentials are present. Myotonic discharges are less commonly present and repetitive discharges are rarely noted. In advanced stages of polymyopathies and muscular dystrophy, there is complete absence of electrical activity. In Myopathy, MUAP is usually of short duration, small amplitude, and polyphasic and have early recruitment.

➢ NCS:

Motor nerve conduction is typically normal although the amplitude of the M–wave is decreased due to few fibers responding to the stimulation. Sensory nerve conduction should be normal and late responses are usually of no help.

4. Radiculopathy:

It is a lesion of a specific nerve root and is generally caused by root compression. Imaging studies (MRI) and electrodiagnosis, both are helpful in confirming the diagnosis of radiculupathy. Patient usually complains if pain in the back of the neck radiating to the arm (cervical radiculopathy) or pain in the back radiating to the legs (lumbo – sacral radiculopathy).

Electrodiagnostic findings:

➢ EMG:

Insertion activity is increased. In spontaneous activity, fibrillation potentials and positive sharp waves are present. In early stages, low amplitude poly – phasic potentials and in later stages, high amplitude poly – phasic potentials are seen. Recruitment abnormality is seen as decreased recruitment.

➤ NCS:

Both motor and sensory conduction studies are normal and are not more useful. Late responses give some information. In dorsal root involvement, H – reflex is diminished and F – wave is normal.

5. Plexopathy:

Brachial plexopathy and lumbo – sacral plexopathy are difficult to examine due to complexity in the anatomy. Common causes of plexopathy are tumors, haematoma, surgical damage and trauma.

Electrodiagnostic findings:

➤ **EMG:**

In abnormal spontaneous activity fibrillation potentials are present along with positive sharp waves. In chronic lesions, MUAP is of long duration, high amplitude and polyphasic. Recruitment is usually decreased in all affected muscles.

➤ NCS:

Both sensory and motor nerve conduction velocities are normal but the amplitude is decreased. H – reflex and F – wave are not helpful in diagnosis of plexopathy.

6. Motor neuron diseases (MND):

MND represent a group of diseases that have the primary pathology located in the spinal cord. The disease affects both the upper and the lower motor neurons. These diseases include poliomyelitis, syringomyelia, amyotropic lateral sclerosis, progressive bulbar palsy and spinal muscular atrophies.

Electrodiagnostic findings:

➤ EMG:

In abnormal spontaneous activity fibrillation potentials are present along with positive sharp waves. Fasciculations and complex repetitive discharges may also be noted. MUAP may show increased duration, large amplitude and polyphasic potentials. Recruitment is decreased.

➤ NCS:

Motor nerve conduction is normal with normal latency and decreased amplitude. SNCV is normal. Late responses are not helpful here.

7. Spinal stenosis:

Spinal stenosis can be defined as the narrowing of the vertebral canal that can affect any spinal level. Patients with spinal stenosis usually complain of back or neck pain radiating to one or both of the extremities.

Electrodiagnostic findings:

➤ EMG:

In acute neural compression, fibrillation and positive sharp waves are present in spontaneous activity. In chronic neural compression, MUAP with large amplitude, polyphasic and increased durational is present.

➤ NCS:

Motor nerve conduction velocity and amplitude is normal. If the disease has progressed to a point where there is significant axonal damage, motor nerve conduction amplitude is decreased. Sensory nerve conduction velocity and amplitude is normal and unaffected because the sensory nerve ganglion is located outside the spinal canal. In late responses, the H – reflex may be prolonged or absent bilaterally. If the S_1 nerve root is affected, then F – wave cannot help in diagnosing the disease.

8. Myotonia:

It is a disorder characterized by delayed relaxation of the previously contracted muscle that results in stiffness of the muscle. The disorder includes Myotonic dystrophy and myotonia congenital.

Electrodiagnostic findings:

➢ EMG:

In spontaneous activity, high frequency repetitive discharges are present with alternately increasing and decreasing amplitude. Myotonic discharges are present and are provoked by needle insertion or movement.

➢ NCS:

Motor nerve conduction velocity is decreased and there is a marked reduction in the motor unit activity and strength. Sensory nerve conduction velocity is also decreased. In late responses, H – reflex and F – wave latencies are prolonged.

9. Myasthenia Gravis:

This is an autoimmune disorder characterized by weakness and excessive fatigability confined to ocular, palatal or pharyngeal muscles. It is a disorder of neuro – muscular transmission characterized by weakness followed by repetitive contraction.

Electrodiagnostic findings:

➢ EMG:

In spontaneous activity, fibrillation and positive sharp waves may be present in severely affected muscle indicating loss of innervation. MUAP shall appear normal at first and then shall progressively decrease in the amplitude with continued effort.

➢ NCS:

MNCV and SNCV, both are normal. Repetitive stimulation during a nerve conduction test will cause progressive decrease in the amplitude of M – wave. Late responses are not helpful in diagnosis of these diseases.